Environmental and Economical Impact of PV Energy Production 22.10.2013, EMPA Academy, Dübendorf

 **Prof. Dr. Frank Alain Nüesch**	**EMPA, Dübendorf ZH** frank.nueesch@empa.ch | www.empa.ch Dr. Frank Nüesch graduated in physics in 1989 at the ETH. In 1995 he earned his PhD at the EPFL in the Laboratory of Prof. M. Grätzel, the inventor of the dye sensitized solar cell. Since April 2004 he is heading the Laboratory for Functional Polymers at EMPA Dübendorf. He is a lecturer at EPFL, teaching thermodynamics and organic semiconductors. **Labtour and Welcome**
 **Prof. Dr. Ayodhya Nath Tiwari**	**EMPA, Dübendorf ZH** ayodhya.tiwari@empa.ch | www.empa.ch Ayodhya N. Tiwari is the head of the Laboratory for Thin Films and Photovoltaics, EMPA, and Titular Professor at ETH. He is the Chairman and cofounder of Flisom AG. The Flisom company has developed proprietary manufacturing equipment and processes for low cost production of flexible monolithic solar modules with roll-to-roll processes. He has more than 30 years of R&D experience in various photovoltaic technologies. Important contributions of Tiwari's group include: development of highest record efficiency flexible solar cells: 20.4% efficiency CIGS and 13.8% efficiency CdTe solar cells with processes suitable for roll-to-roll manufacturing; monolithic interconnected flexible solar modules; more than 19% efficiency CIGS and 15.5% efficiency CdTe solar cells on glass with processes suitable for in-line production; simple and safe non-vacuum deposition processes for CIGS and Kesterite solar cells; low temperature non-vacuum deposition of highly transparent and conducting ZnO:Al layers; coatings for smart windows. **Labtour**
 **Dr. Christoph Harder**	**President Swissphotonics, Schindellegi SZ** harder@swissphotonics.net | www.swissphotonics.net Dr. Christoph S. Harder received the Electrical Engineering Diploma from the ETH in 1979 and the Master and PhD in Electrical Engineering in 1980 and 1983 from Caltech, Pasadena, USA. He is co-founder of the IBM Zurich Laser Diode Enterprise which pioneered the first 980nm high power pump laser for telecom optical amplifiers. He has been managing during the last few years the high power laser diode R&D effort in Zurich expanding, working closely with a multitude of customers, the product range into 14xx pumps as well as 808 and 9xx multimode pumps for industrial applications. He has published more than 100 papers and 20 patents and has held a variety of staff and management positions at ETH, Caltech, IBM, Uniphase, JDS Uniphase, Nortel and Bookham. **Moderation**

Dr. Hans-Jörg Althaus

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Hans-Joerg Althaus holds a M.Sc. in Material Science and a PhD in Environmental Science, both from the ETH. After several years in industrial research and development of solar energy systems, he conducted LCA research mainly on materials, energy systems and mobility at EMPA. As of 2013 he is LCA Expert and scientific coordinator for Quantis Zurich.

Calculation of energy payback time and its determinants

Energy payback time (EPBT) is the result of a complex system model which includes the entire chain of processes involved in producing, operating and disposing off the PV system. EPBT is not an objective value but it is determined by choices and assumptions. This presentation shows how EPBT is calculated and how choices and assumptions influence the result.

Mariska de Wild Schloten

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Mariska de Wild-Scholten studied geochemistry at Utrecht University. From 1998 to January 2011 she worked at the Energy research Centre of the Netherlands (ECN) in the department Solar Energy. Since 2003 she is working in the area of Life Cycle Assessments of Photovoltaics. Now she is self-employed consultant at SmartGreenScans. She is Photovoltaics-subject-editor of the International Journal of Life Cycle Assessment and active member of the IEA PVPS task 12 which deals with Environmental, Health and Safety Aspect of Photovoltaics.

Life Cycle Assessment of Photovoltaics

In this presentation the latest results will be shown regarding energy payback time and carbon footprint of commercial photovoltaic systems based on new 2011 manufacturers data for monocrystalline-, multicrystalline-, amorphous silicon-, CdTe- and CIGS PV modules and 2013 estimates for micromorphous silicon PV modules from an equipment manufacturer.

Dr. Masakazu Ito

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Masakazu Ito is a JSPS Postdoctoral Fellow for Research Abroad researching at CEA, INES in France. He is studying on a Life Cycle Analysis (LCA) and a remote sensing for Very Large Scale Photovoltaic Systems. He earned his PhD from Tokyo University of Agriculture and Technology. Then, he was an assistant professor at Tokyo Institute of Technology.

A comparative LCA study on potential of very-large scale PV systems

A LCA of 20 different PV modules installed in a Hokuto mega-solar plant in Japan, and a LCA of very large-scale PV systems assumed to be installed in desert area have been dene. 1.4 to 3.8 years of energy payback time and 31 to 71 g-CO_2/kWh CO_2 emissions rate were obtained from the systems.

Prof. Dr. Vasilis Fthenakis

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Dr. Vasilis Fthenakis is a professor at Columbia University and a senior scientist at Brookhaven National Laboratory. He serves in international scientific and industry advisory committees. He is the co-author of 4 books and about 300 scientific articles and reports. His research and dissemination by leading publications and presentations, provided the underpinning of PV technologies in terms of their lifecycle impacts.

Holistic Life Cycle Analysis with focus on CdTe Photovoltaics

Life-cycle analysis is an invaluable tool for investigating the environmental profile of a product or technology from cradle to grave. This methodology is exemplified by studies of the life-cycle impacts of CdTe PV systems in a holistic context accounting for all material flows and potential emissions in large-scale PV penetration scenarios.

Prof. Dr.
Jenny Nelson

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Jenny Nelson is a Professor of Physics at Imperial College London, where she researches novel photovoltaic materials and devices. Her current research addresses molecular and hybrid semiconductor materials and their application to printable solar cells. She also works with the Grantham Institute for Climate Change on evaluating the mitigation potential of photovoltaics. She has published over 200 journal papers and a book on the physics of solar cells.

The carbon emissions mitigation potential of emerging solar photovoltaic technologies

In the development of new photovoltaic (PV) technologies, a key question is how their emissions mitigation potential compares with the prevailing technology. Here we will present results on the life-cycle and cost analysis of an emerging PV technology, organic PV, and use simple models to evaluate the carbon intensity and marginal abatement cost of different PV technologies when applied to rural electrification and when used as part of a low-carbon growth scenarios.

Thomas
Nordmann

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Nordmann works since 38 years in Solar Energy.
1975 he started at the *EIR* today *Paul Scherrer Institute PSI.*
1985 Nordmann founded his own business *TNC Consulting AG.*
He developed 1989 the world's first 100 kW PV noise barrier installation along a Swiss motorway.
Nordmann was President of the Swiss Solar Industry Association 1992-1999 & vice-president of the *Swissolar* till 2002.
He received Swiss solar price in 1994, 1998, 1999 and the European solar price 1997.

From PV Systems to Energy Solutions

Overview

- What makes Photovoltaic in buildings so important?
- Why should we combine the efforts for sustainable domestic buildings in the thermal-, electrical-, and grid-network sector?
- What is the potential to combine future electrical cars with PV applications in buildings?
- A new Index for energy sustainable residential and commercial buildings
- Seven Conclusions

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